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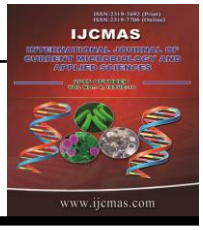


**Original Research Article**

# Study of Bacteriological Profile of Urinary Tract Infections in a Tertiary Care Teaching Hospital

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UTI, Significant bacteriuria, Urinary pathogens, Nosocomial infection, Antibiogram.

**A B S T R A C T**

Urinary tract infection is one of the most common bacterial infections seen in clinical practice particularly in developing countries. The causative agents for Urinary tract infection vary from place to place and they also vary in their susceptibility and resistance patterns. Present study was conducted to determine the spectrum of causative agents responsible for UTI and to detect the extent of drug resistance. A total of 800 clean catch, mid-stream urine (10 ml) samples [Males-310 (38.75%), Females-490 (61.25%) were collected in a universal container from subjects who have not received antimicrobials within the previous fifteen days. 800 samples 487 (60.87%) showed significant bacteriuria. Isolation rate was higher in females (69.59%) as compared to males (29.9%). As drug resistance among bacterial pathogens is an evolving process, regular surveillance and monitoring is necessary to provide physician's knowledge on the updated and most effective empirical treatment of UTIs.

## Introduction

Urinary Tract Infection (UTI) is the most common bacterial infection in human population and also one of the most frequently occurring nosocomial infections (Gastmeir *et al.,* 1998). UTIs refer to the presence of microbial pathogens within the urinary tract and it is usually classified by the site of infection as bladder (cystitis), kidney (pyelonephritis) (Gonzalez and Schaeffer, 1999). It has been estimated that globally symptomatic UTIs result in as many as 7 million visits to outpatient clinics, 1 million visits to emergency departments, and 100,000 hospitalizations annually.

The prevalence of UTI depends on age, sex, co-morbid conditions, genital hygiene etc (Wilson and Gaido, 2004). Urinary tract infection is more common in women because the urethra is short, making it easy for bacteria to spread. Sometimes bacteria can also spread from another part of the body through the bloodstream to the urinary tract (Jaiswal *et al.*, 2013). The most common pathogenic organisms of UTI are *Escherichia coli, Staphylococcus saprophyticus* and less common organisms are *Proteus sp., Klebsiella pneumoniae, Pseudomonas aeruginosa, Enterococci* and

*Candida albicans* (Jaiswal *et al.,* 2013).

Treatment of UTI is often started empirically and therapy is based on information determined from the antimicrobial resistance pattern of the urinary pathogens (Wilson and Gaido, 2004). The prevalence of antimicrobial resistance among urinary pathogens has been increasing worldwide due to injudicious use of antibiotics in practice especially *E. coli*, to previously prescribed drugs like Cotrimoxazole has become a global reality (Manges *et al.,* 2001).

The study was to determine the spectrum of causative agents responsible for UTI and to detect the extent of drug resistance.

## Materials and Methods

The study was conducted in the department of Microbiology, in a tertiary care teaching hospital in the northern part of the Karnataka. The study was done from July 2012 to December 2013. A total of 800 clean catch, mid-stream urine (10 ml) samples [Males-310 (38.75%), Females-490 (61.25%)] (Table 1) were collected in a universal container from subjects who have not received antimicrobials within the previous fifteen days. Specimens were transported and processed within 2 hours of collection by the standard microbiological technique (Winn *et al.,* 2006). Isolation of uropathogens was performed by a surface streak procedure on both blood and Mac Conkey agar using calibrated loops for semi-quantitative method and incubated aerobically at $37^0$C for 24 hours. A specimen was considered positive for UTI if a single organism was cultured at a concentration of $10^5$cfu/ml. The pathogens were identified by standard microbiological techniques by studying Gram stain, their colony characteristics, morphology and biochemical reactions (Collee *et al.,* 2007).

Antibiotic sensitivity was done by Kirby Bauer disk diffusion method on Mueller-Hinton agar plates using commercially available HiMedia discs. The following antibiotic discs were used: ampicillin (AMP-10µg), amikacin (AK-30µg), ceftazidime (CX-30µg), cefotaxim (CTX-30µg), ciprofloxacin (CIP- 10µg), cotrimoxazole (COT-25µg), gentamycin (GEN-10µg), imipenem (IMP-10µg), nitrofurantoin (NIT 300µg), piperacillin+tazobactum (PIT-100/10µg).

## Results and Discussion

Out of 800 samples 487 (60.87%) showed significant bacteriuria. Maximum patients showing significant bacteriuria belonged to 21–30 age group with 77.4 % positivity followed by 70.1% growth rate in 0-10 year of age group. Presence of Significant bacteriuria was least (34.6%) in 11–20, followed by (54.1%) in 31–40 age group. Isolation rate was higher in females (69.59%) as compared to males (29.9%). Difference between significant bacteriuria in different age groups of patient's is found to be statistically significant (Table 2).

In this study the Gram negative bacilli accounts for 68.1% and gram positive accounts for 31.9%. Among the gram negative Organism *E. coli* was the most commonly isolated urinary pathogen (59.2%), followed by *Klebsiella* spp. (31.8%) and *Acinetobacter* spp. (5.2%) while only 3.8 isolates showed Proteus as the causative organism. In the gram positive bacteria the most common organism identified was CoNS accounting for 54% of cases, followed by *Staphylococcus aureus* 38%, *Enterococci* 6.9% and *Candida* sp 1.1% (Table 3).

The antibiogram of the isolated pathogens is shown in table 4. Among the tested antibiotics the highest susceptibility for the

Gram negative bacteria was shown by piperacillin-tazobactam, imipenem, amikacin, gentamicin and ciprofloxacin followed by nitrofurantoin, ampicillin. *E. coli* which was the predominant isolate gave high susceptibility to imipenem 91.7% and piperacillin-tazobactam 88.8% followed by amino glycosides and β-lactams, *Klebsiella*, the second most isolated organism, also showed high susceptibility to Imipenem 90.8%, amikacin 61.7%, gentamicin 49.4% and piperacillin-tazobactam 72.6% and ceftazidime 39.2 %. Similar pattern of susceptibility was shown by *Acinetobacter* with 98.6% susceptibility to imipenem.

Amongst Gram positive bacteria's *Staphylococcus aureus* was commonest isolate showing susceptibility to linezolid 84.6%, gentamicin 72.2%, amikacin 60.4%, ceftazidime 60.2% and ciprofloxacin 56.6% while it was most resistant to ampicillin 22.6%. CONS showed relatively higher susceptibility to all the antibiotics tested as compared to *S. aureus*.

**Table.1** Sex wise distribution of UTI cases

| Sex | Total no of patients | No of positive cases | Percentage |
|---|---|---|---|
| Males | 310 | 146 | 47.10% |
| Females | 490 | 341 | 69.59% |
| Total | 800 | 487 | 60.87% |

**Table.2** Distribution of significant bacteriuria cases in different age groups

| Age in years | No of samples | No of significant bacteriuria cases | Percentage |
|---|---|---|---|
| 0-10 | 171 | 120 | 70.1% |
| 11-20 | 185 | 64 | 34.6% |
| 21-30 | 248 | 192 | 77.4% |
| 31-40 | 85 | 46 | 54.1% |
| 41-50 | 28 | 16 | 57.1% |
| 51-60 | 52 | 31 | 59.6% |
| >60 | 31 | 18 | 58% |
| Total | 800 | 487 | 60.87% |

**Table.3** Frequency of pathogens isolated form cases

| Gram negative | Percentage of isolates | Gram positive | Percentage of isolates |
|---|---|---|---|
| *E.coli* | 59.2% | CoNS | 54% |
| *Klebsiella sp* | 31.8% | *Staph aureus* | 38% |
| *Acinetobacter* | 5.2% | *Enterococci* | 6.9% |
| *Proteus sp* | 3.8% | *Candida* | 1.1% |

**Table.4** Percentage of antibiotic sensitive urinary isolates

| **Antimicrobial agent** | ***E.coli*** | ***Klebsiella*** | ***Acinetobacter*** | ***Proteus*** | ***CoNS*** | ***Staph aureus*** | ***Enterococci*** | ***Candida*** |
|---|---|---|---|---|---|---|---|---|
| Ampicillin | - | - | - | - | 38.6 | 22.6 | 18.8 | - |
| Amikacin | 84.1 | 61.7 | 68.8 | 34.6 | 100 | 60.4 | - | - |
| Gentamicin | 76.4 | 49.4 | 26.8 | 28.8 | 78.8 | 72.2 | - | - |
| Ciprofloxacin | 34.2 | 22.9 | 24.8 | 20.4 | 68.4 | 56.6 | 38.8 | - |
| Imipenem | 91.7 | 90.8 | 98.6 | 100 | - | - | - | - |
| Piperacillin – tazobactum | 88.8 | 72.6 | 76.8 | 100 | - | - | - | - |
| Nitrofurantoin | 67.6 | 32.6 | 66.4 | 64.6 | 72.6 | 54.6 | 46.8 | - |
| Linezolid | - | - | - | - | 88.4 | 84.6 | 88.6 | - |
| Ceftazidime | 54.7 | 39.2 | 21.8 | 25 | 52.8 | 60.2 | - | - |

The appropriate choice of antibiotic for UTI requires an adequate understanding of epidemiology and profiles of local antimicrobial resistance of associated uropathogen. Antibiotic sensitivity pattern has changed over time (Palikhe, 2014). Effective management of patients suffering from bacterial UTIs commonly relays on the identification of the type of organisms that caused the disease and the selection of an effective antibiotic agent to the organism. Diagnosis of UTI is a good example of the need for close cooperation between the clinician and the microbiologist (Water *et al.*, 1996). In our study the prevalence rate of isolation of urinary pathogen was 60.87% closely resembling a study by (Das *et al.*, 2006).

Prevalence of UTIs was more in females when compared to males. This was in agreement with other studies by Bashir *et al.* (2008) and Getenet and Wondewosen (2011). Women are more prone to UTIs than men because, in females, the urethra is much shorter and closer to the anus (Dielubanza and Schaeffer, 2011). Most common prevalence was found in 21–30 year age group having 77.4% patients followed by 0–10 year age group having 70.1%. A similar study conducted by Vijaya Swetha *et al.* (2014). In females UTI was seen commonly in patients between 21 and 40 years age group due to increased sexual activity during this period and in males it was seen in older age group between 41 and 60 years. The incidence of UTI increases in males as the age advances because probably because of prostate enlargement and other related problems of old age.

A variety of enteropathogenic bacteria are known to cause UTI worldwide. As is evident from the results, this study demonstrated *E. coli* to be the predominant aetiological agent (52.4%) amongst the gram negative bacilli and *Staphylococcus aureus* amongst the gram positive bacteria (68.8%) as the causative agents of UTI. These findings are similar to other studies (Gupta *et al.*, 2002). The second most common isolated pathogen among Gram negative bacilli was *Klebsiella* in our study. This was in agreement by Khameneh and Afshar (2009) and Chin *et al.* (2011).

The isolates of most of the species exhibited a high rate of resistance to ampicillin, gentamicin, ciprofloxacin & nitrofurantoin. This pattern of resistance has also been reported within the country from different states (Gupta *et al.*, 2002). From other parts of the world also, such pattern has been

reported. Gram positives showing high susceptibility to linezolid, amikacin & gentamicin (Uwaezuoke and Ogbulie, 2006). Among the tested antibiotics the highest susceptibility for *E. coli* was shown by imipenem (91.7%), piperacillin-tazobactam (88.8%), amikacin (84.1%), gentamicin (76.4%) similar to study by (Gupta *et al.*, 2002).

Successful treatment of patients suffering from bacterial UTIs commonly relays on the identification of the type of organisms that caused the disease and the selection of an effective antibiotic agent to that organism. In this study we have shown growing resistance pattern to these anti microbial agents.

In conclusion, as drug resistance among bacterial pathogens is an evolving process, regular surveillance and monitoring is necessary to provide physician's knowledge on the updated and most effective empirical treatment of UTIs. Periodic reassessment of *in vitro* susceptibility pattern of urinary pathogens to serve as a guide for antibiotic therapy since these organisms exhibit resistance to first-line drugs used for UTI infection. In order to prevent or decrease resistance to antibiotics, the use of antibiotics should be kept under supervision, should be given in appropriate doses for an appropriate period of time.

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